

The Youth of Today!

Dies lecture by Prof. Dr. P.M. (Michiel) Westenberg, during the 433rd dies natalis of Leiden University, on Friday 8 February 2008 in the Pieterskerk

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We are living in a period of considerable indignation and concern about our young people. If we believe the media, there is little right with today's youth: they drink too much, they over-indulge in sex and violence, they hang around the streets and disturb the neighbourhood, they are irresponsible in taking risks and not thinking about the future, they have no concern for other people and are only interested in their own gain, they are self-indulgent and lazy, and are obsessed by the internet. In education, there is a culture of 'a pass is good enough' - and these malingerers then have the nerve to go on strike!

We hear the occasional positive comment, but, on the whole, the attitude is very negative. And, as often happens with groups which are the focus of criticism, as a reaction, young people begin to cultivate their own separate identity. Take, for instance, the rap band *De Jeugd van Tegenwoordig* (The Youth of Today). In the summer of 2005, they had the hit *Watskeburt* (What's happened?). Indeed, a good question: what has happened? What is going on with our young people? In answering this question, I will restrict myself to adolescence: the start of adolescence is marked by the beginning of the process towards sexual maturity - puberty.

For a long time, we have assumed that adolescence is an inherently difficult phase, particularly because of puberty. This was put down to the hormones raging through the veins of our youngsters. In 1762, Jean-Jacques Rousseau published his famous book, *Emile*. Rousseau hypothesized that humans are born twice: the first time from their mother, the second time metaphorically, when the young person becomes an adult in psychological terms, as a consequence of puberty. Rousseau regarded the process of maturity as a state of crisis, in which the child rejects adults and is temporarily impossible to educate. The sudden fits of temper stir up an enormous storm, and parents need all the strength they have available in order not to lose their grip.

The idea of a stormy adolescence was established by the magnum opus of psychologist G. Stanley Hall. Hall was a prominent psychologist in the US, whose vision of adolescence had far-reaching consequences. Key to his view was the notion that adolescence is a period of *Sturm und Drang*, named after the like-named movement in German literature. Hall was mainly inspired by an epistolary novel by Goethe, *Die Leiden des jungen Werthers*. The young Werther falls in love with a girl who is already engaged. The situation seems hopeless, and in the end he commits suicide. This clearly shows that Hall failed to understand not only the behavioural problems of this phase of life, but also the emotional and relationship problems.

Hall adhered to a recapitulation version of evolutionary theory. According to this theory, the development of each individual briefly mirrors the evolution of the species. Adolescence was thought to reflect the period when animals became civilized

humans. This was said to be a very turbulent period, which every adolescent has to re-experience. The recapitulation theory was short-lived, but the notion of *Sturm und Drang* which it inspired continued. The problem of adolescence was universal and unavoidable, because it was inherent in biology. For the adolescent, a matter of sitting it out, and for the parent or educator a case of trying to keep the upper hand.

The notion of unavoidable crisis re-appeared in the second half of the last century in different assumptions about adolescence: psychoanalysts such as Anne Freud emphasized the issue of detachment. The separation from the mother supposedly aroused strongly ambivalent emotions. Anna Freud was even of the opinion that a calm adolescence was abnormal. Erik Erikson placed the emphasis on finding one's own identity at a point in time when the way forward was no longer determined by one's parents or by society. This apparently resulted in a crisis of identity.

Many of the reflections on adolescence were based on clinical cases and literary works. There was a lack of empiric research among large groups of young people. Does the average adolescent actually show signs of extremely rebellious behaviour, serious detachment problems or a painful identity crisis? It is only since the last two decades of the present century that psychologists and psychiatrists have carried out serious empiric research into the ups and downs of adolescents. The emphasis was mainly on the unavoidable downs. How bad are they actually?

In fact, things were apparently not as bad as they seemed: the number of young people with serious emotional and behavioural problems was less than 15%. Most adolescents sail through puberty without any serious storms or stress. The course of serious problems does not mirror the pattern of a rising and ebbing storm. If there are such problems, these often do not disappear at the end of adolescence; once a storm rages, it does not generally abate of its own accord. A stormy adolescence is no guarantee of a calm adulthood. Moreover, serious problems in adolescence are often preceded by problems in childhood. And to top it all: the advent of puberty is apparently not responsible. After centuries of attributing the blame to puberty, scientists were astonished to learn that puberty apparently has no direct effect on the development of serious problem behaviour. It has taken many research projects before this conclusion was finally accepted.

So, there certainly are serious problems, but these are not the result of puberty. To explain these problems, we have to look at completely different factors, such as genetic sensitivity and unfavourable circumstances. Moreover, we are talking about a minority of about 15% of young people. So what are the typical characteristics? Aren't the rest also troublesome, albeit to a lesser extent?

Problem behaviour, and linking it with puberty, have clouded our view of natural development. The aim of my lecture is, for a change, to put natural development at the forefront; to show what drives our young people. This may make it easier to attach the right value to problem behaviour and to respond to it appropriately.

I will briefly summarize the state of affairs relating to three important aspects of development: the development of puberty, psychosocial development and cognitive development. You will see that development proceeds quite differently from the stereotypical image of difficult puberty: steady progress is being made in all areas.

You will also see that psychosocial and cognitive development takes longer than the development of puberty. I will put this observation in the context of recent research into the development of the brain in adolescence.

Let us begin with puberty. What course does it normally take, and what are its effects?

1. The development of puberty

The work of paediatrician James Tanner has played an important role in research into the course and effects of puberty. In 1972, he published the Tanner stages of sexual development. Research with the Tanner stages demonstrated that there are much greater differences in the timing and duration of puberty than had been assumed. Puberty can start as early as 8, but may also not begin before the age of 14; it lasts on average 3.5 years and can vary from 2 to 6 years. Using the Tanner stages makes it possible to study the relationship with behaviour independent of calendar age. Hormone analysis and animal research have also generated important information about the effect of puberty on behaviour.

As I mentioned, there appears to be no relationship between puberty and serious problem behaviour. The link with so-called problem behaviour is also much more tenuous than was thought. Moreover, it appears in most cases to be a side-effect of a positive development. I will give three examples:

1. The proverbial laziness of adolescents is not an expression of contrariness, but is rather the result of rapid growth and of changing sleep patterns;
2. The fact that adolescents have a short fuse and are easily thrown off balance is not a sign of an emotional crisis, but is rather the consequence of growth hormones and of changes in the pituitary gland and the hypothalamus, whereby the stress system is adjusted to adult level;
3. More frequent conflicts with parents are not so much a sign of resistance and detachment, but are often caused by the desire to spend more time with friends of a similar age, including those of the opposite sex. Parents feel they are being traded in, but research proves the opposite is the case: for the average adolescent, parents continue to play an important role. The only difference is that parents lose their position of exclusivity: during the course of the teenage years, peers steadily become as important as parents. This is something parents have to adjust to.

It may be good to hear that parents continue to be important to their teenagers, but it does mean you have an important task: what you do or don't do serves as an example to your child, including in the teenage years. If something goes wrong, you can't simply blame it on the wrong friends.

Some parents are concerned that their teenager may become sexually active at too young an age: we are more likely to discourage them to take the first step than to urge them on, as we did with walking and reading. However, most parents have no need for concern, because research has shown that the majority of young people only become sexually active a number years **after** puberty.

Based on scientific research, we may then conclude that the effect of puberty is generally positive: children develop steadily into adults without suffering any emotional or relationship crisis.

2. Cognitive development

Cognitive development – the development of intellectual skills – is the second aspect which I would like to discuss. There is no Tanner scale for cognitive development. We have to deal here with specific age-related changes. Research demonstrates a steady increase in intellectual capabilities. There is no question of a temporary relapse during puberty in the ability to make judgments.

Firstly, we see an increase in all kinds of specific capabilities. Working memory and information processing improve in terms of efficiency and capacity, spatial awareness improves, and logical reasoning reaches a higher level. This is partly seen in an increase in deductive reasoning. It enables adolescents to think in abstract terms and to test a logical argument separate from reality. As an example: we can tell a young person that we assume: ‘All elephants are small’ and then ask him the question: ‘This is an elephant; is it small?’ Because this is in direct conflict with the truth, young children have difficulty with such reasoning, while it’s a piece of cake for secondary school children. They actually enjoy this kind of questioning: they drive their parents and teachers mad with their questions. As far as this is concerned, they are born Sophists. The adults around them often fail to appreciate it, but it is a demonstration of clear progress in their way of thinking.

Recent research by colleague Jelle Jolles from the University of Maastricht shows that there are big differences in the timing of these developments. His research has shown that some children perform less well at working memory tasks, but that they recover this shortfall during early adolescence. These children are no less intelligent, but are simply slower. Others have already reached their ceiling at an earlier age. We have to take care that we do not mistake developmental differences for stable individual differences.

As well as progress in these separate aspects of intellectual capabilities, there is also greater awareness on the part of the adolescent of his ability for individual thought and an increasing ability to direct and control his own learning behaviour. This is known as metacognition. Research within our department demonstrates a strong increase in skills in the area of metacognition among children and adolescents in the ages from 9 to 22. Metacognition is not the same as intelligence: intelligence refers to cognitive skills such as spatial awareness and language skills, whereas metacognition refers to the ability to reflect on one’s own thought processes.

Parents who help their teenagers with homework often make the mistake of presuming the metacognition which for themselves is so obvious. They ask their children to reflect on their own solution strategies. This is simply not possible and then the parents demand in desperation: ‘Think before you say or write anything,’ and are surprised when their child stamps off. It may well be that your child is intelligent, but is not yet capable of reflecting on his own thought processes. The fact that he storms off is not primarily related to puberty, but to your unrealistic expectations.

Current research is monitoring pupils from the age of 12 to 14. In this period in particular, a crucial foundation seems to be laid for metacognition at a later age. Have secondary school pupils developed sufficiently to be able to cope with the study house? The average student may well be able to manage, but we have to realize that there are great differences in the quality of metacognition between pupils within all age groups. Some children are already able at a young age to plan their learning behaviour and to control it and reflect on it. Others seem to still find this difficult at the age of 22.

We can draw the conclusion that cognitive development demonstrates a steady increase well into late adolescence, with considerable variation between individuals.

3. Psychosocial development

The third line of development which I would like to discuss is psychosocial development, which is the development of insight into oneself and others. This is the most difficult part. Psychosocial development has been the subject of discussion since time immemorial: how does it work and what can we expect at the end of adolescence?

According to Laurence Steinberg and Elizabeth Cauffman, authoritative researchers in the field of adolescent psychology, psychosocial development consists of progress on the following aspects: 1. the ability to control one's own impulses and emotions, 2: autonomy in relation to parents and peers, 3. the capacity to empathize with another individual and to appreciate different opinions, and 4. awareness of responsibility for oneself and others.

The authors make no pronouncements on how development proceeds. They assume a gradual increase on all fronts, but how this takes place, and the steps which it involves are not discussed. How does an individual edge his way from lack of responsibility to responsibility? Is this a gradual process, or does it take place in leaps and bounds, such as with the development of puberty? The second problem is the dependence on calendar age as a measure of adulthood. This was also the problem with puberty fifty years ago: it was not possible to measure puberty effectively independent of age. This only became possible with the introduction of the Tanner scales.

Inspired by the work of my teacher Jane Loevinger, and together with colleagues from the department of Child and Adolescent Psychiatry of Leiden University, I devised a kind of Tanner scale of psychosocial development. With this tool it is possible to group individuals between 8 and 25 years of age independent of their calendar age. It is based on research among some 3000 children and adolescents.

I will give you a brief impression of our findings. Psychosocial development can be viewed as a series of sliding panels: for each stage of development, a new theme appears. Up to about 9 to 10 years of age, the child is still definitely a child: impulsive, attached and dependent, focused on parents and other educators for instruction, guidance, care and protection. Father, mother, teacher – they all know the way things are and what is and isn't allowed.

On the way to adulthood, four panels appear: at the start of adolescence, the self-protection panel appears. In this phase there is a feeling of self-confidence and

invulnerability: 'I know it all and can look after myself.' Young people in this stage are egocentrically-motivated: everyone has to look after him or herself. Relationships are instruments.: they are primarily assessed for the advantage that can be derived from them. This stage is often confused with puberty. In view of the overlap with age, this is not surprising, but this kind of behaviour also occurs when the young person has not yet entered puberty, or when puberty has already passed.

On average between the 13th and 14th year, the following - conformist - panel appears. The primarily egocentric attitude of the previous phase is exchanged for an attitude of being focused on other people: what the other person thinks or wants is just as important as what you yourself think or want. Young people in this phase exhibit socially desirable behaviour, afraid as they are of criticism and rejection. Relationships are reciprocal: you have to like one another, agree with one another and do things together. Being together with others has become a goal in itself.

At around the age of 17 or 18, the third - self-aware - panel appears. The focus on others makes way for the inward-looking approach of the self-aware person. People are concerned with their own feelings, their own wishes and qualities, even – or maybe particularly – if these are not in line with what is socially desirable: 'I am what I am.' Individuality and integrity are important qualities, but there is an awareness that these can lead to disagreement and rejection. In view of the differences between people, individuals adopt a tolerant and flexible attitude: what is 'good' depends on the person and the circumstances.

The point at which the following - responsible - panel appears varies too strongly to link it to a particular age. The self-observant attitude of the previous stage makes way for a focus on self-development and self-improvement. It is not only a matter of 'Who I am,' but 'Who I can or should become.' In this phase, an individual believes he is responsible for the correctness of his assumptions, for the consequences of his behaviour and for his or her own personality. Where necessary, self-correction takes place in line with the individual's own norms.

In other words, the adolescent learns consecutively to stand up for himself, to be part of a group of like-minded individuals and to understand himself and others better. Finally, a feeling of responsibility for his own actions develops.

Can this Tanner model of psychosocial development help us to gain a better understanding of behaviour in secondary schools? I will give three examples from recent research.

The first step in development, the self-protective phase, goes together with rule-breaking behaviour at school. This is the phase in which adolescents themselves decide what is acceptable, and they display a sight level of aversion to authority. Together with colleagues from the Netherlands Institute for the Study of Crime and Law Enforcement, we asked more than 800 first-years from VMBO schools (secondary schools for lower professional education) about how frequently they broke school rules. The study showed that particular violations – such as throwing things in class, or writing on school furniture – were most common in the self-protective phase. Before and afterwards, there was less of this type of behaviour. As far as I know, this

is the first research to demonstrate that difficult behaviour at school fluctuates depending on psychosocial development.

The second step in development, the conformist phase, goes together with an increasing dislike of solo performances, such as making a presentation in class. From this phase, individuals become much more sensitive to the opinion of and possible criticism from others. And a critical view is precisely what you have to experience with a solo presentation: you stand there alone, if it goes wrong, it's your fault, you can't hide behind a friend; in short, there's no getting out of it. Most secondary school children are not keen on making such presentations, they would far rather avoid them. An interesting phenomenon is that children up to the age of 10 report little or no anxiety, while this anxiety increases as a function of development. And it is not just this anxiety that increases, the tendency to avoid public speaking also increases. We know, too, that this is something that most adults dislike. The anxiety increases and doesn't ever disappear again.

To study this phenomenon effectively, thanks to partial science funding, a presentation lab has been constructed to allow us to study public speaking anxiety under controlled conditions, and to examine the physiological reactions, such as heart rate, skin conductivity and stress hormones in saliva. Some 300 school pupils have now made a presentation in our lab. The first analyses of the results confirm our hypothesis: the stress reaction to giving a talk at school is almost absent in young children and increases as a function of psychosocial development.

The third step in development, the self-aware phase, is accompanied by a better understanding of literature. Reflecting on literature is an important aspect of literature teaching in secondary schools: we expect pupils to think about why they liked a book, whether it had something to do with real life, or whether they could make some connection between their own life and that of the character in the book, and whether they are aware that their own norms and values in part determine whether or not they find the character pleasant. Research by two PhD candidates in Groningen has shown that reflecting in this way on literature increases particularly after the self-aware phase. The effect of age and educational level was much less strong. Reflecting in a particular way on literature is thus primarily a function of psychosocial maturity.

Psychosocial development proceeds more slowly than puberty development and appears to continue slightly longer than cognitive development. The development curve rises steadily and evens out around the 24th year. The process is not as rapid as we would like or as we think it should be.

Most young people are only ready to answer the identity question towards the end of adolescence, that is to reflect on their own personality and behaviour. It is therefore no wonder that it is so difficult to choose a study in this phase of their life and that many students give up or change their study. In my opinion, we should take this into account when structuring the curriculum. Might it, for example, be an idea to give students the opportunity to do a minor in the first year? This would offer them the opportunity to try out different studies and to get to know themselves better. Self-knowledge and a good choice of a study go hand in hand.

Just as with puberty and cognitive development, there are major differences in the timing and tempo of psychosocial development. This is probably one of the reasons why we tend to overlook *development*: it is the differences between people of the same age which stand out more. Just as with puberty, we see a gender difference in the rate of development, but only at a later age: from around the age of 14, girls are ahead of boys, but this developmental advantage disappears around the age of 20. This advantage probably has something to do with the better study performance of girls in secondary education. It may not necessarily be as a result of the supposed feminization of education that boys need more time to get into their stride.

We can conclude that psychosocial and cognitive development throughout the whole of adolescence demonstrate a steady increase, with considerable variation between individuals.

Now that we have better insight into the progress of psychosocial and cognitive development, the question remains of why it lasts longer than puberty. Why don't all those pennies drop earlier? And what is the cause of these major differences in the rate of development? Are we not bringing our children up properly, can't we speed up development? These questions have been debated since ancient times. Until we realized in recent years that our brain continues its process of maturation during adolescence. And these are specifically those parts of the brain which support the functions which we just discussed, such as metacognition, social insight and self-control.

In other words, the relatively protracted psychosocial and cognitive development can probably be explained on the basis of the slow maturing of those parts of the brain involved in these functions. What evidence do we have for this?

Brain development in adolescence

For centuries we believed that our brains were fully matured at the end of childhood. After all, the brain of a six-year-old was already 95% of the size of the adult brain. In puberty, it is the arms and legs and trunk in particular which grow, so that by the end of puberty the body has attained adult proportions, with a proportionately smaller head than in childhood. If the head were to grow at the same rate as the rest of the body, the adult head would be the size of a beach ball. That's not what happens. It is not surprising, therefore, that we thought for so long that the brain doesn't change very much during puberty, and certainly not during the subsequent period.

The advent of Magnetic Resonance Imaging, commonly known as scanning, made it possible to study the brains of living people. With this technique it has been demonstrated that the brain continues to mature for longer than we had thought, in any event up to the age of 20, but probably even longer. The most remarkable finding is that the different parts of the brain do not develop synchronously: the development runs roughly speaking from the underneath upwards and from back to front, so that the foremost parts of the brain are the last in line. And in addition, the connections between the front and other parts of the brain are also undergoing continuous development.

Brain research among adults demonstrated a long time ago that particular parts of the brain support specific functions, and that damage to these areas causes these functions

to be lost. But until recently we did not know that these parts of the brain develop according to different time schedules, and that in adolescence they mature one after the other. This is a revolutionary insight and it explains to an extent the ages-old confusion about young people: are they adults or not? In some ways they are, and in others they are not.

That the brain still changes structurally does not automatically mean that the functionality changes drastically. It will all run a bit better and more efficiently, but does it have any real effect on young people's thinking, emotions and behaviour? This is being examined with the functional MRA. With this technique, it is possible to observe the brain in action. While the young person in the scanner carries out a particular task, it is possible to observe which part of the brain is involved. By comparing people of different ages with one another, it is possible to see whether the activity of an area of the brain changes with age. It is only in the past five years that this technique has been applied to study developments in adolescence.

I will give you two examples of this type of research from our own Brain and Cognition Institute, which was set up in 2005 by Eveline Crone as part of Leiden Institute for Brain and Cognition (LIBC). Both examples illustrate the slow maturation process of the frontal areas of the brain.

1. The first example relates to research into the maturation of the parts of the brain related to emotion and of those areas connected to directing and controlling particular functions. Is it the case that the controlling and directing parts develop more slowly than the emotional parts of the brain? I realize that this is a simplification of the very complicated structure and working of the brain; for the sake of clarity, I will now make use of this dichotomy.

One aspect of the emotional brain relates to sensitivity to the positive consequences of behaviour, such as winning money by gambling. This sensitivity is regulated by areas such as the *insula* and the *nucleus accumbens*. The sensitivity to negative consequences of behaviour, loss or punishment are regulated by the pre-frontal cortex, in particular the orbito-frontal cortex. This part is immediately above our eye sockets. As you know, this part of the brain develops relatively late in adolescence. Teenagers are therefore more focused on rewards and pay less attention to loss or punishment. Our expectation is that this sequence is reversed in adulthood.

This hypothesis has been tested in the Brain and Development Lab using the following experiment. With their heads in the scanner, adolescents from 10 to 23 years look at a fruit machine. The fruit machine is a machine for betting, whereby you win if you get a row of three of the same type of fruit. Imagine you are sitting looking at a fully automatic fruit machine: you see the first piece of fruit appear and then the second one. If both pieces of fruit are the same, then there is the chance you might win (if the third piece of fruit is the same) or lose (if a different piece of fruit appears). What happens in your brain and in the brain of a teenager? For everyone, the chance of winning activates the reward areas, and with teenagers, these areas are extra active. What happens in your adult brain as soon as you know whether you have won or lost? If you win, little happens; you simply register it. But with teenagers, the reward areas are strongly activated. If they lose, it has the opposite effect: with you, the part of the prefrontal cortex where negative consequences are processed is strongly active,

but with teenagers, this part is hardly active. The findings support the hypothesis that teenagers are more sensitive to reward than to loss, while the opposite is true for adults.

In the first half of adolescence, the relatively immature, rational part of the brain at times loses out to the more active, emotional part of the brain. Laurence Steinberg calls this starting the engine without a good driver at the wheel. He uses this discrepancy to explain the increase in high-risk behaviour in adolescence: the emotions and rewards gain the upper hand, while the controlling part of the brain is not able to resist.

2. The second example relates to the assumed link between psychosocial development and the relatively slow development of the prefrontal cortex. Research among adults has unequivocally demonstrated that the prefrontal cortex plays a crucial role in social behaviour, particularly if such behaviour is dependent on the ability to understand and appreciate the point of view of others. For this type of behaviour, the medial prefrontal cortex in particular plays a crucial role: this area is at the front of the head.

To date, very little developmental research has been carried out. This is an almost undeveloped field, which is now being explored by staff of the B&D Lab in collaboration with colleagues from social psychology. This research looks at the development of confidence and reciprocity, two important aspects of working and living together. This experiment focuses on two players who have to share money. The first participant is given a pot of money which he can use as he wishes: he can keep it himself, or he can give it to the other participant (I call this person the 'giver'). If he passes the money on, then the stake will be raised. The second player (I call this person the 'returner') can then keep everything or share it, so that both parties have something. The first player exhibits trust, and the second player can betray that trust or honour it. We call this last option, reciprocity: someone does something for you and you do something in return, so that both parties benefit.

The findings of this experiment are as expected: the development of reciprocity increases steadily as a function of the stages in psychosocial development just described. There is no sudden reduction in puberty; adolescents are no less pleasant than younger children. There is evidence of a gradual increase in the tendency to give back: children are at their most selfish around the age of 9, and from this age onwards the tendency to give back increases gradually, reaching a peak in the self-aware stage of development. Moreover, they increasingly react to different forms of manipulation: the higher the risk and the higher the potential benefit, the more they are inclined to give something back. This shows an increasing insight into the position of the giver and an increasing readiness to reciprocate.

You may question whether this is maybe just a game and whether it says anything about normal life. Then you have to consider that this research was completely anonymous: the returner could have taken everything, without any damage to his reputation. Apparently, the inclination to reciprocate at a particular moment in time is something internal and no longer has to be enforced. Economists tend to mistrust altruistic motives. They will be amazed at these results.

And what about the brain? Is the increase in reciprocity indeed related to the development of the medial prefrontal cortex? This is today's cliff-hanger: fMRI research is currently being carried out to find the answer to this question and we expect to be able to report progress in a few weeks. It is an exciting area of research.

This situation gives a good reflection of the state of affairs relating to brain research in adolescence: we know more or less what we can expect, but closer analysis shows that little has been published on the link between the development and maturation of the adolescent brain. Worldwide, there are just a few centres which have fully mastered this research. We may consider ourselves fortunate that Leiden has the necessary expertise and facilities. This type of research will teach us a great deal about the necessary expertise and facilities.

Brain research among adults has long ago shown that particular parts of the brain support specific functions and that damage to these areas leads to loss of these functions. But until recently we did not know that these parts of the brain developed according to separate schedules and that they reach maturity one by one in adolescence. This is a revolutionary insight and it explains in part the ages-old confusion about our young people: are they mature or not? In some ways yes, and in others, no. Should they know better? Yes and no.

Why do the parts of the brain related to emotion and to control develop asynchronously? Why does the PFC develop more slowly than the emotional part? It would be more useful if they developed synchronously. We can also turn it around: why does puberty take place so early? The timing of puberty has long been a mystery and it is still not completely clear. It has been known for some time that good care and good health speed up puberty, but the genetic background has only just become at all clear. As far as I am aware, nothing is known about the factors which influence the maturing of the controlling part of the brain: which genes and conditions have influence on this? This is still a mystery. We suspect that puberty and brain development are based on independent factors, but we don't know for sure.

Should parents and educators then sit back and wait until all the areas of the brain have matured? Certainly not, because the brain can be trained and it is conceivable that the prefrontal cortex in the adolescent stage is more susceptible to influence. It is a critical period for learning specific skills such as planning and reciprocity. Prosocial behaviour and morality do not emerge spontaneously from the brain, any more than language comes from the brain. The environment has to offer the right stimuli at the right time. This is the nature of development: it is the reverse side of the interaction between maturing and environmental influences. Environmental influences can probably have an effect on the maturing of the brain, just as is the case with puberty. Further research will have to prove this.

Conclusion

What does all this say about our young people? Adolescence is not limited to puberty. It is a phase of development which covers much more and lasts longer than the development of puberty.

On all fronts things are going in the right direction. The only complication is the great differences in tempo within and between individuals. Within each adolescent the

development of puberty, the cognitive and then the psychosocial development are completed one after the other. The fact that not everything completes development at the same time gives a confusing and inconsistent picture, which is seen by educators as malicious sabotage or character weakness. They should know better, shouldn't they? Yes and no. Just have a little more patience and things will be fine.

The great variation in the rate of development *between* adolescents is equally confusing and difficult for those bringing up children and for teachers: what can we expect from pupils of a particular age? The developmental differences are almost too great to allow a clear answer to this question.

These discrepancies in development by no means make matters any simpler, but this is light years away from the idea that adolescence, and in particular puberty, is an inherently problematic phase. Adolescence is not about weathering a storm, but about welcoming all kinds of capacities and insights.